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195. Proposed by J. EDWARD SANDERS, Reinersville, Ohio.

Particles slide from rest at the focus of a parabola, whose axis is vertical, down radius vectors, and are then allowed to move freely. Find the locus of the foci of their subsequent paths.

DIOPHANTINE ANALYSIS.

139. Proposed by PROF. R. D. CARMICHAEL, Anniston, Ala.

$2^{n-1}(2^n-1)$ is a multiply perfect number of multiplicity 2 when 2^n-1 is prime. Prove that there are no other multiply perfect numbers containing only 2 distinct primes.

140. Proposed by R. D. CARMICHAEL, Anniston, Ala.

Determine (any way) whether the Diophantine equation $\left(\frac{2x-1}{3}\right)^3 = x^2 + y^2$ has any positive integer solutions.

141. Proposed by PROF. R. D. CARMICHAEL, Anniston, Ala.

Given that the highest factor of a prime p contained in $m!$ is p^{m-s} ; find general expressions involving p and m and s , from which, when a solution is possible, m can be determined when s is a given integer and p is a given prime. Is it then possible in any case to have more solutions than one?

AVERAGE AND PROBABILITY.

181. Proposed by W. J. GREENSTREET, M. A., Editor of the *Mathematical Gazette*, Stroud, England.

At a sea-side excursion for x men there are boats enough for q men and carriages enough for z . But p do not care for driving, and q would feel indifferently comfortable on the water, while the rest do not care either way. Each man has what he prefers as long as a seat is left for him in carriages or boats, and those who do not care either way choose at random. Find the chance that all will be satisfied.

182. Proposed by L. MORDELL, Philadelphia, Pa.

Out of n straight lines whose lengths are 1, 2, 3, 4, ..., n inches, respectively, the number of ways in which 4 may be chosen which will form a quadrilateral in which a circle may be inscribed is $\frac{1}{48}[2n(n-2)(2n-5)-3+3(-1)^n]$.

MISCELLANEOUS.

163. Proposed by J. EDWARD SANDERS, Reinersville, Ohio.

Two straight streams of different volumes and velocities come together. Find the path of a body floating in mid-current of either.

164. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, England.

Find the number of real roots of the equation $100\sin x = x$, and show the largest root is approximately 96.10. Find $\tan 39^\circ$ to three places of decimals. How many real roots of $\tan x = 1/x^2$ lie between 0 and 2π ?

165. Proposed by R. D. CARMICHAEL, Anniston, Ala.

$$\text{Prove that } \tan^{-1} \frac{n}{n+1} + \tan^{-1} \frac{1}{2n+1} = \frac{1}{4}\pi.$$

166. Proposed by F. H. SAFFORD, Ph. D., The University of Pennsylvania.

Several equal rectangular boxes are placed in a row with uniform intervals between the boxes and a passageway along one side of the row. Find the least width of the passageway permitting a box to be removed from the row without moving adjacent boxes. This problem arose during the construction of a room for storage batteries.

167. Proposed by DR. OSWALD VEBLER, Princeton University, Princeton, N. J.

If possible, arrange 43 objects, say the numbers 0, 1, 2, ..., in 43 sets of seven each such that every pair of objects lies in one and only one set of seven. It will then be true that two sets of seven have in common one and only one object.*

*The analogy of this arrangement with the points in an ordinary projective plane is obvious, the "objects" corresponding to points and the sets of seven to lines. A similar arrangement with a smaller number of objects is the triple system,

0	1	2	3	4	5	6
1	2	3	4	5	6	0
3	4	5	6	0	1	2

in which seven objects are arranged in sets of three. Other examples are to be found in an article by O. Veblen and W. H. Bussey on *Finite Projective Geometries* in the Transactions of the American Mathematical Society, Vol. 7, page 241, and in an article by O. Veblen on *The Foundations of Geometry* in The Popular Science Monthly for January, 1906.